UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Title: BRIEFING ON BASIC SAFETY PRINCIPLES FOR NUCLEAR POWER PLANTS

Location: Washington, DC

Date: Wednesday, April 6, 1988

Pages: 1 - 41

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BRIEFING ON BASIC SAFETY PRINCIPLES FOR NUCLEAR POWER PLANTS

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PUBLIC MEETING

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Nuclear Regulatory Commission

Room 1130

1717 H Street, Northwest

Washington, D.C.

Wednesday, April 6, 1988

The Commission met in open session, pursuant to notice, at 2:00 p.m., the Honorable LANDO W. ZECH, Chairman of the Commission, presiding.

COMMISSIONERS PRESENT:

LANDO W. ZECH, Chairman of the Commission

THOMAS M. ROBERTS, Member of the Commission

KENNETH CARR, Member of the Commission

STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

S. CHILK

V. STELLO

H. DENTON

W. PARLER

H. KOUTS

PROCEEDINGS

[2:00 p.m.]

CHAIRMAN ZECH: Good afternoon, ladies and gentlemen. Commissioner Bernthal and Commissioner Rogers will not be with us this afternoon. Commissioner Roberts will be joining us shortly.

This afternoon the Commission will be briefed on the International Nuclear Safety Advisory Group -- the INSAG report, entitled "Basic Safety Principles for Nuclear Power Plants." This report was recently released by the International Atomic Energy Agency at their symposium on severe accidents in March of 1988.

Dr. Herb Kouts was chairman of the INSAG working group who prepared this report, and is here today to summarize the recommendations of the document.

I would like to welcome you today here, Dr. Kouts. We appreciate your long and substantial service to our country and we are delighted that you are with us here today. It is my understanding that the Executive Director for Operations, Mr. Victor Stello, and Mr. Harold Denton, the Director of our Office of Governmental and Public Affairs, will also provide their insights into this significant report.

The report promotes a safety philosophy for everyone involved in all the various aspects of commercial nuclear power plant development and operation. The Commission has recently

received copies of the IAEA report, which we have here, and we will of course take some time to review the report itself, but we are pleased to have this briefing today.

I understand copies of the slides to be used during the presentation are available in the back of the room.

I emphasize that this is an information briefing and no formal Commission action is anticipated at the meeting today.

Do any of my fellow Commissioners have any opening comments?

[No response.]

CHAIRMAN ZECH: If not, Mr. Denton, would you please proceed?

MR. DENTON: Yes, Mr. Chairman.

The International Nuclear Safety Advisory Group, so-called INSAG, was formed in 1985 by the Director General, so they are an advisory body to the Director General of the IAEA. It had a dozen or 13 members, all of whom were well known experts in reactor safety. It includes Dr. Kouts, of course, and people you know -- Dr. Birkhofer, Mr. Tanguy, Mr. Siderenko.

This group wrote the official IAEA report on the Chernobyl accident, and I believe it was that accident that really was the impetus for producing this basic principles report that we have today, and the report does talk about

principles for existing and future reactor types, but there is special attention given in it to those principles that emerged from post-accident analyses.

Herb will be the first speaker. Herb, of course, is well known to you. As of April 1st, he stepped down from his job as the head chairman of the Department of Nuclear Energy at Brookhaven to become a scientist again, apparently after serving in that capacity for over a decade -- and, of course, you remember he used to be Director of the Division of Research right here in the NRC.

After Herb's presentation, Vic will describe and discuss the uses that the NRC might make of this report.

CHAIRMAN ZECH: All right. Thank you very much.

Dr. Kouts, welcome again. Please proceed.

MR. KOUTS: Thank you very much, Mr. Chairman, Commissioners.

The document I am going to talk about is "Basic Safety Principles for Nuclear Power Plants." It follows the intent that the International Atomic Energy Agency and its Director General had when they formed INSAG in 1985, which was to develop, where possible, commonly shared safety principles, commonly shared meaning commonly shared across the surface of the earth.

This was a concept, in fact, which dates to Mr. Manning Munsing, who foresaw the need for an organization and

an activity of this sort a few years before, and through the National Association of Engineering Societies arranged for the International Atomic Energy Agency to try the INSAG concept and its activity on a trial basis.

It was after the Chernobyl accident in 1986 that there was a meeting in Vienna sponsored by the International Atomic Energy Agency, at which one of the principal recommendations was that INSAG should now get on with the job of preparing these commonly shared safety principles, and that has been the origin of this book.

CHAIRMAN ZECH: All right.

[Slide.]

MR. KOUTS: In agreeing to do this, INSAG was motivated by the realization that -- as my first slide indicates -- that although there are some 400 nuclear plants which have come to fruition in the world, two of these have had severe accidents which have destroyed them, and this led in turn to some 31 deaths of individuals who were involved in the Chernobyl accident.

Now in other activities, in other industrial industries which have as extensive a background as nuclear power has, this might be considered a not bad level of safety, but INSAG recognized that the nuclear field is faced with stronger requirements than have been imposed on other industrial endeavors, and even a safety record which is good

for most industrial operations would not be adequate for the nuclear field.

So the safety principles are directed toward an improvement of that record, and I will tell, as I go on, just how that improvement is to be achieved.

Also guiding the deliberations that led to the document was a realization that especially since the Chernobyl accident there has been a maturing and a converging of certain concepts around the world, so that this seemed a propitious time for trying to achieve the kind of document which had been sought from a group of this sort.

Commonly shared safety principles now seem to become a possibility.

[Slide.]

MR. KOUTS: Furthermore, again, as on my next slide, the international consequences of accidents in nuclear power plants were also recognized following the Chernobyl accident and it became clear that we now have a need for safety principles which can be accepted on an international basis, so that activities in one country can be acceptable, or at least there is a touchstone to determine whether the activities are acceptable in other countries as well.

So these are the motivations which led to preparation of this document at this time.

The document begins with some introductory

discussion, such as a preface and an introductory part, in which certain areas which are necessary for the interpretation and application of the principles are taken up.

First of all, the document is directed toward nuclear plants of current types. Now by current types, I mean not only light water reactors, which of course we are predominantly interested in in this country, but other nuclear power plant types which may be used in different countries around the world. That includes fast breeder reactors as they are used in France and in the Soviet Union, gas cooled reactors as they are used in a number of countries, heavy water reactors -- all reactors of current types had their safety characteristics examined from a standpoint of formulation of this document and it is meant to apply universally to all of these.

Now, there are some restrictions in the document. First of all, it is a document which is pertinent to electricity generating plants. We have concentrated on this. However, it was pointed out by our Soviet colleague that a number of plants in the Soviet Union are now directed toward space heating of apartment buildings, industrial complexes and that the safety principles that we were devising had more general applicability -- or most of them did, at any rate, and so it is pointed out that this broader applicability is still possible.

However, there are some nuclear plants that are under

consideration, particularly in this country, which some of their proponents have termed "inherently safe" types. We did not up take up the question of inherently safe reactors. We took the view that these are safety principles that are meant to be applied universally, and if there are certain principles which be virtue of plant design are not necessarily to be covered by these principles, this is a situation which one would have to argue again, rather than argue from the other end.

That is the coverage from a standpoint of which plants are treated.

The question of new plants versus old plants also comes up, and the question of backfit. As you will see, we have different objectives for old plants and for new plants and make the comment that for backfitting with respect to old plants, one has to take into account a number of considerations. There must be a balance, a balance being achieved through a cost benefit study to determine to what extent the backfit is required.

Recognizing that nothing is absolutely safe and the search for absolute safety is a fruitless one, secondly it is necessary to optimize the use of resources. One would not want to devote large amounts of resources to areas of improvement that have only marginal benefit.

Thirdly, that some improvements have downsides as

well, and it is necessary to consider what might be wrong with an "improvement" as well as what might be achieved with it.

So these are the considerations that have to be taken into consideration in the backfit situation.

[Slide.]

MR. KOUTS: In the next slide, I have a note to the effect that we have to recognize that, although nuclear plants use high technology, and this is considered by many people to be a source of fear, at least by the general public, because high technology is so poorly understood, in fact, it is necessary and it is proper to take advantage of high technology to achieve safety in nuclear power, and, as a matter of fact, with high technology, one can achieve higher levels of safety than one can achieve in ordinary industrial endeavors.

This is a source of strength and not of weakness, and it is, in fact, the underpinning of safety in nuclear power, because it's the basis for use of defense in-depth and safety rests on defense in-depth in this field.

[Slide.]

MR. KOUTS: Emphasized in the document is a concept of safety culture which is a concept which was stated in our report on the Chernobyl accident. Safety culture is the pervasive presence of safety thinking which must accompany activities by all individuals who are active in the process of production of nuclear power. It's a safety thinking among all

those concerned in these activities and we bring in the concept of safety culture and its application in many places throughout the document. I would like to return to this shortly.

[Slide.]

MR. KOUTS: A couple of more aspects of the document. The document is not a regulatory document. It is not directed toward regulatory use. That is, it's not formulated in a style which could be readily adopted by regulatory organizations. It is, in fact, a document which is directed more to the nuclear industry, and is associated with what we consider to be the quest for excellence which nuclear industry should be expected to be undertaking.

For this reason, the document is written in the present tense. Everything is said as if the practices and the principles which are discussed in the document are, in fact, in current use. Now, as a matter of fact, almost everything in the document is in current use in one place or another. After all, we were seeking commonly safety principles and if we introduced ideas which were radical, or brand new, they would not be commonly shared principles.

So, you will find that much of what I have to say, reflects practices that you are familiar with. You will find that the document, however, written in this way, is a structured document which tells why and what and how to achieve what is recommended.

The report was originally, in our first thoughts, to be a kind of deductive report. We wanted to establish objectives to be achieved and then, to whatever extent we could, derive from the objectives the things which should be done to achieve the objectives. We found that this is not really possible. It's not possible to derive all of nuclear plant safety as an exercise in logic from the objectives themselves, but this led us to a tiered approach in which we have objectives, some fundamental principles and some specific principles; each layer of which overlays those below and in which each successive tier becomes more specific. We ended these tiers, however, before we got to specific types of nuclear plants because we wanted the generality.

[Slide.]

MR. KOUTS: We have three objectives. Twelve fundamental principles and fifty specific principles in the document and the specific principles are more specific applications of the general principles, but you will find that specific principles commonly are related to more than one fundamental principle; and they all are related to several of the objectives. I'd like to just go through the objectives.

[Slide.]

MR. KOUTS: As I said, there are three objectives. They are not independent objectives. They are interrelated. There is a general objective and there are two objectives

which, in a sense, are means of achieving the general objective. The general objective is to protect individuals, society and the environment by establishing and maintaining in nuclear power plants, an effective defense against radiological hazard. This is a concept which is not unfamiliar to you gentlemen and, as a matter of fact, is not inconsistent with objectives which you have discussed as safety goals in your deliberations. In fact, we see this as representative of an international consensus on safety goals, or on safety objectives, as these have been discussed in many countries.

[Slide.]

MR. KOUTS: The second safety objective is a radiation protection objective. I have given it a shorthand statement on my slide. It really reads, "to ensure in normal operation, that radiation exposure within the plant and due to any release of radioactive material from the plant, is kept as low as reasonably achievable," which is the ALARA concept, "and to ensure mitigation of radiation exposure due to accidents." Each of these objectives and each of the principles which follow as concise a statement of the principle and the objective as we could possibly give it. The idea being, that we wanted to achieve a statement which somehow could be born in mind. But, we could not enfold in the statement itself all of the things we wanted say in this connection.

So, there is a discussion section which follows, and

the discussion section enlarges on the short statement, gives the extent of it, gives the exceptions to it, and clarifies the meaning. That's done in the objectives I'm reading out and, for instance, in this particular objective, there's a discussion of non-stochiastic and stochiastic effects of radiation and the fact that the statement itself is directed toward both of these kinds of radiation. The second safety objective is a very long one, and a very important one. It's on page 8 of your document and I've given it just a shorthand statement on my slide which is that accidents are to be prevented and especially to be prevented are accidents with high consequences.

[Slide.]

MR. KOUTS: In fact, there are three aspects to this technical safety objective; the prevention of accidents, the prevention of accidents with high consequences and the prevention of high consequences from accidents; and these are not really the same thing. They are different things and they are implemented in different ways in the course of the document's unfolding.

There is a target which is established in the discussion of the technical safety objective. This target is a probability of severe core damage for nuclear power plants which does not exceed 10 to the minus four per year for existing plants, 10 to the minus 5 for plants in the future,

for plants of future construction and off-site consequences which require extensive off-site measures, or any off-site measures at all, an order of magnitude less probable than these numbers. This is a safety objective which, again, you would not find unfamiliar to you.

[Slide.]

MR. KOUTS: There are twelve fundamental principles; three of these are related to management, three of them to defense in-depth, and six of them, for want of a better term, are called technical principles, and I'd like to run through them with some reasonable speed, if I may, and then go into some of the specific principles.

The fundamental principles on management; the first of these is that an established safety culture governs the actions and interactions of all individuals and organizations engaged in nuclear power activities. In this principle, we state the components of a safety culture. There are many components and many implications of the concept.

Included are: the requirement for dedication and accountability on the part of all individuals involved in these activities, a dedication which starts with senior management of the organizations involved, including the senior management of the operating organization, who establish clear policies and clear lines of responsibility and communication among their staff, with strict adherence to requirements, with reviews and

training of their staff, leading to an openness with respect to safety questions on the part of the staff and a questioning attitude concerning safety matters. This is the principle which outlines the requirements to be achieved in the quest for excellence.

[Slide.]

MR. KOUTS: The second fundamental principle is one which is closely related to this Commission. That is, that the ultimate responsibility -- I'm sorry, I'm not at that one -- this says that the ultimate responsibility for the safety of the nuclear power plant rests with the operating organization. This is in no way diluted by the separate activities and responsibilities of designers, suppliers, constructors and regulators. In this, we are not discussing financial responsibility, but moral and procedural responsibility.

This responsibility is such that when a nuclear plant operator accepts his plant from whoever has constructed it for him, he accepts all responsibility for what has gone before and what is to go after. This is a cradle-to-grave responsibility.

At the same time, there are other responsibilities of other organizations involved; suppliers, constructors, designers and also a responsibility of the technical community to ensure that the proper backup in safety is always available to be used by the industry.

[Slide.]

MR. KOUTS: The next fundamental principle is the one I started to refer to. The Government establishes the legal framework for nuclear industry and independent regulatory organization. This is, again, shorthand and I really want to read the full statement as it is in the document. "The principle establishes the legal framework for a nuclear industry and an independent regulatory organization which is responsible for licensing and regulatory control of nuclear power plants and for enforcing the relevant regulations. The separation between the responsibilities of the regulating organization and those of other parties is clear; such that the regulators retain their independence as a safety authority and are protected from undue pressure."

This last statement is one which we were requested specifically to have put in by some of the smaller countries in which the maintenance of this clear responsibility by the regulatory organization is sometimes jeopardized.

COMMISSIONER ROBERTS: Would you elaborate on that? What undue pressures?

MR. KOUTS: Well, this was a subject for long discussion inside our group as we wrote this, and the pressures themselves were never clearly stated by the individuals who said that they felt them in their countries.

These are pressures in countries where the independence of the regulatory organization is not so clear at

the outset, and I could name countries which I feel have this problem, but I don't think this is an appropriate time to do so.

Generally, however, these are usually small countries in which governmental organization is not as extensive and well developed as it is in this country.

As you know, the Nuclear Regulatory Commission has this unique character of not being an administrative organization responsible to the administrative side of the government, and it has a legislative responsibility and an administrative responsibility as well. This is not so in many countries, and the common thing in most countries is that the regulatory organization is directly under the administration of the country, so that the possibility for pressures to be applied exists there as is does not exist in the United States.

I hope that makes it a little clearer.

COMMISSIONER ROBERTS: Well, that's fine. Thank you.

[Slide.]

MR. KOUTS: The principles of defense-in-depth are three in number.

The first of these is a statement to be achieved through defense-in-depth and that is my shorthand statement on the next slide. Defense-in-depth is provided through a set of physical barriers which are meant to ensure that radioactive material in the plant is confined in regions where it is

supposed to be. These barriers are not to be jeopardized, and for this reasons various mechanisms and procedures are built into the plant design and into plant operations -- to ensure that the barriers remain intact and that radioactive material continues to be confined.

There is an appendix in the report which discussed defense-in-depth very extensively, and I recommend it to the readers. It is a very good appendix. It was largely put together by our Soviet compatriots.

[Slide.]

MR. KOUTS: The next principle of defense-in-depth says that particular attention is provided to the primary means of achieving safety, which is the prevention of accidents, particularly those which could cause severe core damage.

This principle in its discussion makes it clear that this is to be achieved through a number of measures which are necessary -- quality in construction and design, inspection in the process of construction and design, monitoring in construction, design and in operation at a later time, and appropriate training of all individuals who will have responsibilities in the operation of the plant.

[Slide.]

MR. KOUTS: The next fundamental principle is on accident mitigation and management. It says that in plant and off site mitigation measures are available or prepared for

which would ensure substantial reduction of the effects of any accidental release of radioactive material.

There are, in fact, several components to this fundamental principle, and they are discussed in connection with it.

The first of these is accident management, and accident management is given a strong position in this report. I will take up accident management on its own in a little while.

A second part is engineered safety features which are accident management features built into the design which provide an inherent mitigative component to the design of the plant.

And the last is off-site counter measures which may be prepared for in the event -- to be exercised in the event that all other measures to prevent the accident have not been successful.

There are then a number of fundamental principles dealing with more technical matters and I'll go through these quickly.

[Slide.]

MR. KOUTS: There is the fundamental principle on design involving assured practices. Nuclear power plant technology is based on engineering practices which have proven by testing and experience and are reflected in approved codes

and standards and other appropriately documented statements. This is the requirement for standards and for use of such standards, not only in the design of a plant but in the supply of components, in the manufacture and in the operation at a later time. In all of these, and in maintenance and repair, in all of these activities use of approved, appropriate standards is called for.

[Slide.]

MR. KOUTS: There is a fundamental principle on quality assurance, which is closely related. Quality assurance is applied throughout nuclear power plant activities as part of a comprehensive system to ensure with high confidence that all items delivered and services and tasks performed meet specific requirements. This has essentially the same coverage as the previous principle and is related to achievement of quality and to the documentation of this achievement.

[Slide.]

MR. KOUTS: A fundamental principle of training: Personnel engaged in activities bearing on nuclear power plant safety are trained and qualified. Design and operations promote safety through preventing wrong actions and compensating for their effects. This is the human factors principle, and included in the discussion are the means by which human factors can be built on in order to achieve safety and to avoid problems.

[Slide.]

MR. KOUTS: There is a principle on safety analyses which states -- I have a paraphrase in my slide -- detailed safety assessments are made before design and operation of a plant begin. These are well documented, independently reviewed and updated as necessary. This principle is stated in such a way that it does not specify the number of reviews to be called for.

Now in the course of a safety review, one could have one-step licensing, one could have two-step licensing, depending on the national requirements and the specific needs. The principle describes the contents of a safety analysis report and introduces the need for probablistic analysis to accompany deterministic analysis in the safety review.

A fundamental principle on radiation protection which implements the objective on radiation protection -- I need not read it.

[Slide.]

MR. KOUTS: A fundamental principle on operating experience feedback and the need for safety research, which we consider extremely important. Organizations concerned ensure that operating experience and the results of research relevant to safety are exchanged, reviewed and analyzed and that lessons are learned and acted on, and this is a responsibility and a principle which applies to many organizations at the same time

-- to plant staff, to the regulatory organization and to industry.

[Slide.]

MR. KOUTS: This is the last of the fundamental principles. As I have said, there are 50 specific principles. The principles of a specific character are put in a form which advances from the earliest concepts of the plant -- when siting is being considered -- to the time when the plant is in operation and even may go through to decommissioning.

Those principles are included in the first five categories on this slide: siting, design, manufacturing and construction, commissioning and operation. There are also two other categories of specific principles, dealing with the possibility that accidents might occur to plants and that there will be a need to do something as a result.

So, there are three principles on accident management and three principles on accident preparedness.

[Slide.]

MR. KOUTS: As I said earlier, these are concepts, principles and objectives which one finds broadly used throughout industry, throughout the world. Some of the concepts we have pushed a little farther than one finds in many places, and I have listed the principal ones of these on my next slide.

That is, first of all, the use of probabilistic risk

analysis in safety analysis at the outset. I should say first that these may not be absolutely new to the Nuclear Regulatory Commission. Some of these are in fact being implemented by the Commission, but they are not -- all of them -- broadly accepted in this form throughout the world. PRA to be used in safety analysis.

The second is reliability targets for safety systems. In some quarters it has been proposed that reliability targets be established on the basis of various events having assigned probabilities associated with them for each plant. This would be a sub-division of probability of accident occurrence which we are not in accord with. We do not believe that this makes very much sense. It does not allow for the constructors, designers and operators of nuclear plants to make the trade-offs on safety which are necessary to achieve optimum safety, but this particular concept is stated in the form that if any safety analysis which includes a risk assessment, credit is taken for a certain reliability of a certain safety component of the plant. There should be some basis for judging that that reliability is achieved, and this is precisely what is said here.

There is a discussion in the specific principles of training and qualification of maintenance personnel. This goes beyond what is done in many places, but we recognize that many of the problems that are had with respect to nuclear plants are

the result of failures in maintenance and maintenance organizations.

CHAIRMAN ZECH: Could you talk to us just a little bit more on the reliability targets, just very briefly. In other words, could you elaborate on how the reliability target could be demonstrated, perhaps for a new safety system that might be contemplated. What was the discussion that resulted in your reference to reliability targets in safety systems?

MR. KOUTS: The discussion did not establish how reliability targets should be verified. That is a matter which will have to be taken up in connection with each application.

I could direct a few of my thoughts toward this.

CHAIRMAN ZECH: Yes, please do -- just briefly. Thank you.

MR. KOUTS: Some application of this principle is already made within the Nuclear Regulatory Commission. There are reliability targets for containments which require testing of containments as the -- I'm not sure which appendix to Part 50. Appendix J of Part 50 applies here. There are reliability targets for the emergency diesel systems. There are well-established methods by which reliability of these components is established and maintained in the process of operation, well, before operation and after operation of the plant.

CHAIRMAN ZECH: I was thinking of specifically for advanced reactor designs and perhaps for designs in advanced

reactors you don't really have the established data for what kind of reliability targets and how would you proceed towards something you don't have all the data for.

Did you have any discussion on that?

MR. KOUTS: Well, we did in an earlier principle, where we talked about proven engineering principles, in which we talk about how tests are to be made on a component or system basis or either in miniature -- not in miniature -- scale tests, or on systems as they are to be constructed and used or how reliability could be based on firmly established analytical models and how these models are to be verified and on what basis reliability can be vested in them.

CHAIRMAN ZECH: All right. Thank you.

MR. KOUTS: There is a discussion of this in that section.

CHAIRMAN ZECH: All right. Thank you.

To get back to the training and qualification of maintenance personnel, this is the concept which extends somewhat beyond its application in many places. We also have a similar extension with respect to the instruction of operating staff in the results of probabilistic risk assessments pertinent to the plant.

This does not mean that operating staff are to be instructed in the PRA or to be even able to understand the PRA, but they should understand the significance of the PRA from the

standpoint of what are the possible things they should be prepared to work against in the operation of the plant.

[Slide.]

MR. KOUTS: Finally, we include a section on accident management and discuss accident management procedures and training.

I would like to briefly illustrate the design process as part of the document devoted to specific principles. The design process has three specific principles attached to it, one on proven management, one on proven technology and the general basis for design. The general basis for design is an extremely important principle and a very long one.

I have two slides with respect to each one of these. Design management, statement of design management, assignment and subdivision of responsibility for safety are kept well defined throughout the design phase and during any subsequent modification.

To illustrate how the discussion goes, design management is to be under a single manager, the design manager, who is responsible entirely for the design of the plant, and who is responsible for establishing an organization with clear interfaces and clear assignment of responsibility.

He does include in his staff a safety coordinating group which is responsible of ensuring that all of the activities associated with building and the safety of the plant

are adequately met and who is also responsible for coordinating the safety aspects of these among the various groups. This safety coordinating group is also responsible for ensuring that the operating group is coordinated to the assigned group. This is a practice which architect engineers commonly use. Quality assurance is used in the design configuration control, is importantly implied.

COMMISSIONER CARR: Now that single manager design concept goes from a reactor all the way through balance of plant?

MR. KOUTS: Yes. There is one man who's responsible for putting it all together.

CHAIRMAN ZECH: Let me ask a question, too, on this design management subject. For example, I didn't see that the report addresses the question of containment performance. Maybe you didn't get into that level of specifics, but it seems to me that I would be interested to know if there was any discussion of current containment performance or any objectives for future plants for containment performance? Was that discussed under this design concept that we are looking at here?

MR. KOUTS: No. Containment was not specifically discussed, but the concept of confinement was discussed, confinement as a means of restricting the dispersal of radioactive material in case it becomes liberated from fuel.

The activity of confinement is discussed at substantial length. What think you are asking about is found only in this objective -- technical safety objective -- in which we state that the probability that off-site measures would be needed as a result of an accident should be at least an order of magnitude less than the probably of severe core damage itself.

So this in itself contains implicitly a kind of containment/performance criteria, without specifically saying so.

CHAIRMAN ZECH: But you didn't get into the specifics of containment performance?

MR. KOUTS: No, we did not.

CHAIRMAN ZECH: All right.

MR. KOUTS: We recognized the fact that the objective of confining radioactive material after an accident can be met by a number of methods and it gets very complicated to try to analyze them method by method.

CHAIRMAN ZECH: But you didn't get into any of those specific methods?

MR. KOUTS: No, we did not.

CHAIRMAN ZECH: All right. Thank you. You may proceed.

[Slide.]

MR. KOUTS: The second specific principle is a

restatement of design purposes of the use of proven technology as stated in the fundamental principles, and I will just pass over those two slides and get into the general basis -- it should be "general basis" instead of "general basic" for design.

[Slide.]

MR. KOUTS: As I said, this is a very important principle, and I would just like to read it. "A nuclear power plant is designed to cope with a set of events including normal conditions, anticipated operational occurrences, extreme external events and accident conditions. For this purpose, conservative rules and criteria incorporating safety margins are used to establish design requirements. Comprehensive analyses are carried out to evaluate the safety performance or capability of the various components and systems of the plant."

[Slide.]

MR. KOUTS: In the discussion section, it is made clear that this means that no plant damage should result from normal operation. No plant damage should result from reasonably expected events. The role of engineered safety features is then introduced and design basis accidents are defined. There is a somewhat new concept here, because it is pointed out that the including of engineered safety features to prevent plant damage should lead in the long term to the elimination of any risk outliers in the safety analysis.

There should be no single means by which the plant is threatened in a way outside compared to any other way.

COMMISSIONER CARR: By plant damage you mean core damage?

MR. KOUTS: Yes, we mean core damage.

[Slide.]

MR. KOUTS: My last slide relates to accident management, and I state it simply to emphasize the fact that accident management is dealt with at such length in the report. This is not a report. This is not a set of big safety principles addressed to accidents. It is a set of safety principles addressed to maintaining the safety of the -- protecting the safety of the public, primarily through protecting the plant itself, but recognizing the fact that accident management measures are necessary.

I'll simply say, however, that the report recognizes two levels of safety -- of accident management.

The first of these is accident management to prevent any accident initiator from developing a sequence which could threaten the existence of the plant and its safety.

The second is accident management after the fact, after an accident damaging the core.

CHAIRMAN ZECH: In your discussions of this accident management topic, did you -- did the group try to come up with any definition of the large off-site release?

MR. KOUTS: No, we did not define a large, off-site release -- a large off-site release is one which requires extensive measures off-site. That is the closest we came to it.

CHAIRMAN ZECH: All right.

MR. KOUTS: We did not include action levels or any concepts of that sort in this report.

CHAIRMAN ZECH: You didn't get into the specifics in that regard?

MR. KOUTS: No, we did not. That scenario we leave to organizations like the International Radiation Protection Committee.

That is the report, Mr. Chairman.

CHAIRMAN ZECH: All right, thank you very much, Dr. Kouts. Appreciate it very much.

Mr. Stello, did you have some comments to make? I know you attended, with Mr. Denton, I believe, the meeting in Sorrento recently, where I believe this was a subject of a discussion over there.

Perhaps you could give us your views on discussions at that time very briefly, and then perhaps comment on Dr. Kouts' presentation.

MR. STELLO: Let me start by observing that as I read and understood this report, a number of times in fact, it became clear to me that this is the kind of document that has

considerable value to the entire nuclear industry.

The point I made at that time, which I firmly believe, if some of the utilities that have had difficulty in the United States had read, understood and faithfully implemented the basic philosophy and policy of this document, they would not have had problems.

I think there is a message in here for all the industry, not just the owners and operators of the utility, but the architect engineers, consultants, regulators, DOE, and anyone else associated with the nuclear industry would benefit would from reading and studying this document.

That led me to what I think is the first point I wish to make, the question of what further distribution ought this document have in the United States, what ought be NRC's view, and I would recommend with the Commission's concurrence that we would undertake widespread, and have gotten permission to copy the document, widespread distribution in the United States to bring this document into the hands of organizations that would indeed benefit from it.

I don't believe that it's even close to suggesting or recommending to the Commission any mechanism by which the Commission would formally incorporate or adopt such a document as part of our regulatory process. That would be some considerable time in the future, if at all. If, indeed, there is any need to suggest that this ought to, in any way, shape or

form, be folded in as a requirement.

In fact, I don't think the document is written in such a way that it is, indeed, intended to be requirements as Dr. Kouts has already said.

There is going to be a task, and I don't know what the next steps will be with IAEA, of responding to the request from IAEA to all the member countries of which the United States is a member, of what our comments might be and suggestions back to IAEA, and I think the Commission may want to consider whether it wishes to offer itself as a vehicle to coordinate the kind of response that go back to IAEA. That's a question that I think will be coming to us shortly.

I think there's no question that within the technical staff, within the general staff of the NRC, that we will -- in fact, I've started to make copies to distribute within the staff so the staff would have the benefit of reading it. I think it is a good document. I think it would not be, in my view, productive to try to fine-tune this document with a lot of detailed requirements. I think the document will serve a very useful purpose. We need to take some next steps and come back to the Commission at some point in the future; perhaps as long as six months from now, depending on what IAEA's views are on the document. I suspect it will be a long term affair.

It's up to the Commission, I think, to react, at least, informally. I would suggest that what I do is to draft

a letter and get widespread distribution of the document, of the information to the industry as the first step and let the others follow as they will.

Harold, did you want to say anything?

MR. DENTON: No.

CHAIRMAN ZECH: Don't have anything else, Mr. Denton, to add to that?

MR. DENTON: No.

CHAIRMAN ZECH: You were at the meeting too, where they discussed the report. Do you subscribe to what Mr. Stello has said and he'd given his views on the value of the document.

MR. DENTON: I think the document is a milestone. That it's got -- a particular virtue is it's scrutable and readable. So much of the technical literature has been written in jargon, in the past, and in textbooks which deal with reactor physics issues and thermal hydraulics. These are stated in principles that everyone in the industry can understand and apply and I think the Committee's done a great job in pulling them together and they are -- they're all that new or novel, but the fact that they're in one place and in one setting you can read them, is a real accomplishment, and I think the group was well -- the report was well received in the meeting where they were presented.

CHAIRMAN ZECH: All right, thank you very much. Questions from my fellow Commissioners? Commissioner Roberts?

COMMISSIONER ROBERTS: No.

CHAIRMAN ZECH: Commissioner Carr?

COMMISSIONER CARR: Yes, I've got one question for Dr. Kouts. Why did you not consider Wind Scale a severe accident?

MR. KOUTS: Well, Wind Scale was certainly a severe accident, but it was not to a nuclear power plant; it was to a production plant. Even though -- it was a dual purpose plant, of course. It's certainly not a plant of modern type, because it was an air-cooled reactor. That is essentially it.

COMMISSIONER CARR: Okay, I would say that the document's a very nice policy statement for overall policy. I certainly, as part of the Commission, wouldn't have any hesitation in endorsing it as a policy statement, if that's what the IAEA expects or something. If they want comments, that -- it's more or less a motherhood type statement and so you could -- it's good words and I think, as you said, Vic, people should have read it a lot of years ago and heeded it and so I offer that comment anyway.

CHAIRMAN ZECH: Thank you very much.

MR. DENTON: If I could respond to that. I think the IAEA will be asking for comments and I would think our aim would be to review it thoroughly, with the aim toward improving it and fostering its use. We'll get that opportunity.

CHAIRMAN ZECH: All right, fine, thank you. Dr.

Kouts, I just had one question. Did the discussion of human factors and personnel errors come into the group's critique and analysis of all of the principles that we've talked about here today?

MR. KOUTS: Very much so. One of the fundamental principles is a human factors principle. We discussed this to a considerable extent and came to the conclusion that human factors have to enter into accident prevention and accident mitigation in two ways. One of these is through design of the plant in the first place; design in such a way as to reduce the possibility that incorrect things will done and correct things will be done when they're necessary, and the second is through extensive training and qualification of personnel. These are points which are strongly emphasized in the document.

CHAIRMAN ZECH: Did the group think that there was adequate attention being given to human factors, as regards commercial nuclear power plants today?

MR. KOUTS: I don't know that that question was ever raised in exactly that form.

CHAIRMAN ZECH: But it was emphasized.

MR. KOUTS: Strongly emphasized, and, in fact, there is a realization in the INSAG organization that the greatest benefits to be gained in reactor safety in the future are probably in the field of human factors. And, as a matter of fact, through accident management measures, measures to

terminate a sequence of events that might be developing and through mitigation measures, again procedures, procedure development for this purpose; substantial benefit could be gained in lowering risk levels in nuclear plants. This is probably the direction which offers the greatest advantage in the future in reduction of risk in nuclear plants.

CHAIRMAN ZECH: Was any significant discussion of maintenance -- did that take place during the discussion period? Maintenance of the power plants themselves?

MR. KOUTS: Absolutely.

CHAIRMAN ZECH: Could you tell us just a little bit about that? I know there's a difference of philosophy in some of the various countries on it. Perhaps you could enlighten us a little bit on the discussion that took place.

MR. KOUTS: We did not review the difference in the way maintenance is treated in different countries, but we certainly reviewed the implications of the reportable events as they come into the Nuclear Regulatory Commission and the fact that they are approximately equally divided among maintenance-caused problems and problems of other kinds. The fact that not enough is being done with respect to maintenance personnel to instruct them, to qualify them, and to make them aware of the importance of their actions.

CHAIRMAN ZECH: Was there any discussion of testing and surveillance, especially at power levels?

MR. KOUTS: We did not discuss that, except for the point made that no activities are to be done without written procedures. Certainly that was discussed in connection with the Chernobyl accident.

CHAIRMAN ZECH: All right. Well, let me thank you very much for your participation and a very fine report. I too feel that -- you know, I recognize that it is difficult on an international scale to attempt to put together a document that can be acceptable to a broad group of nations. I think we should recognize that, as you point out, it is basic safety principles and you haven't gotten into the specifics, as you have emphasized here today several times.

On the other hand, I agree with Mr. Denton and also Mr. Stello that a document of this kind, that has considerable value, especially written in language that can be understood -- and is not as technical as many of the documents that we deal with on a day to day basis. So I think it does have considerable value. I would certainly agree that it should be given widespread dissemination.

I think the Commission should review it carefully and decide whether some further action and endorsement on our part would be appropriate. I think that most of the principles that we talked about here today and that I've had a chance to review in the document are principles that -- as I say, most of them are certainly generally ones that we have already adopted in

our country, and it isn't a lot of new, startling information. it is a compilation in my view of generally sound principles that can contribute towards safety.

So I would suggest that the staff review it carefully too, and come to the Commission perhaps with a recommendation for any further action that you think should be warranted on the part of the Commission in commenting on or in support of the document. It certainly seems one that should be generally accepted. I think we would have to study it a little bit more carefully to see if there is any parts of it that we might have problems with, but I do think, Dr. Kouts, that you and your colleagues have made a valuable contribution to providing in one document some principles that certainly look like they can in general be acceptable.

They do, of course, as far as I can see -- I'll maybe ask you one last question. As far as our development of the safety goal, which took place over a very lengthy period of time as you are well aware, it does appear to me that the principles you have articulated here are quite consistent with our development and our philosophy in developing the safety goal.

Would you care to comment on that?

MR. KOUTS: I think they are completely consistent with the objectives that you have been discussing, yes.

CHAIRMAN ZECH: All right. Thank you very much.

Are there any other questions from my fellow Commissioners?

[No response.]

CHAIRMAN ZECH: If not, we thank you very much for a very fine presentation and for your contribution again to our country.

We stand adjourned.

[Whereupon, at 3:03 p.m., the briefing was concluded.]

SPECIFIC PRINCIPLES

SITING (4)

DESIGN (22)

- DESIGN PROCESS (3)
- GENERAL FEATURES (7)
- SPECIFIC FEATURES (12)

MANUFACTURING AND CONSTRUCTION (2)

COMMISSIONING (4)

OPERATION (12)

ACCIDENT MANAGEMENT (3)

EMERGENCY PREPAREDNESS (3)

PRA TO BE USED IN SAFETY ANALYSIS

RELIABILITY TARGETS FOR SAFETY SYSTEMS

TRAINING AND QUALIFICATION OF MAINTENANCE PERSONNEL

OPERATING STAFF INSTRUCTED IN PRA RESULTS

ACCIDENT MANAGEMENT PROCEDURES AND TRAINING

DESIGN PROCESS

DESIGN MANAGEMENT

PROVEN TECHNOLOGY

GENERAL BASIS FOR DESIGN

DESIGN MANAGEMENT (2)

UNDER A SINGLE MANAGER

CLEAR INTERFACES AND CLEAR RESPONSIBILITIES

A SAFETY COORDINATING GROUP

QUALITY ASSURANCE IN THE DESIGN

CONFIGURATION CONTROL

DESIGN MANAGEMENT (1)

THE ASSIGNMENT AND SUBDIVISION OF RESPONSIBILITY FOR SAFETY ARE KEPT WELL DEFINED THROUGHOUT THE DESIGN PHASE OF A NUCLEAR POWER PLANT PROJECT, AND DURING ANY SUBSEQUENT MODIFICATION.

PROVEN TECHNOLOGY (1)

TECHNOLOGIES INCORPORATED INTO DESIGN HAVE BEEN PROVEN BY EXPERIENCE AND TESTING. SIGNIFICANT NEW DESIGN FEATURES OR NEW REACTOR TYPES ARE INTRODUCED ONLY AFTER THOROUGH RESEARCH AND PROTOTYPE TESTING AT THE COMPONENT, SYSTEM OR PLANT LEVEL, AS APPROPRIATE.

PROVEN TECHNOLOGY (2)

USE APPROPRIATE STANDARDS

VALIDATE ANALYTICAL METHODS

USE REALISTIC OR CONSERVATIVE METHODS

GENERAL BASIC FOR DESIGN (1)

A NUCLEAR POWER PLANT IS DESIGNED TO COPE WITH A SET OF EVENTS INCLUDING NORMAL CONDITIONS, ANTICIPATED OPERATIONAL OCCURRENCES, EXTREME EXTERNAL EVENTS AND ACCIDENT CONDITIONS. FOR THIS PURPOSE, CONSERVATIVE RULES AND CRITERIA INCORPORATING SAFETY MARGINS ARE USED TO ESTABLISH DESIGN REQUIREMENTS. COMPREHENSIVE ANALYSES ARE CARRIED OUT TO EVALUATE THE SAFETY PERFORMANCE OR CAPABILITY OF THE VARIOUS COMPONENTS AND SYSTEMS IN THE PLANT.

GENERAL BASIC FOR DESIGN (1)

NO PLANT DAMAGE FROM NORMAL OPERATION

NO PLANT DAMAGE FROM REASONABLY EXPECTED EVENTS

FOR IMPORTANT ACCIDENT SEQUENCES:

- ESF'S TO PREVENT PLANT DAMAGE
- ESF'S TO MITIGATE CONSEQUENCES

DEFINES DESIGN BASIS ACCIDENTS

NO RISK OUTLIERS

ATTENTION TO MAINTENANCE AND TESTING

ACCIDENT MANAGEMENT

STRATEGY FOR ACCIDENT MANAGEMENT

TRAINING AND PROCEDURES FOR ACCIDENT MANAGEMENT

ENGINEERED FEATURES FOR ACCIDENT MANAGEMENT

400 NUCLEAR POWER PLANTS

2 SEVERE ACCIDENTS

MATURITY OF SAFETY CONCEPTS

INTERNATIONAL CONSEQUENCES OF ACCIDENTS

NUCLEAR POWER PLANTS OF CURRENT TYPES

BALANCE IS NEEDED IN SAFETY

NOTHING IS ABSOLUTELY SAFE

OPTIMIZE USE OF RESOURCES

CONSIDER GOOD AND BAD EFFECTS OF CHANGES

NUCLEAR POWER PLANTS USE HIGH TECHNOLOGY

THIS IS WHY THEY CAN BE SO SAFE

SAFETY CULTURE

STRUCTURE OF THE REPORT

OBJECTIVES

FUNDAMENTAL PRINCIPLES

SPECIFIC PRINCIPLES

GENERAL OBJECTIVE

TO PROTECT INDIVIDUALS, SOCIETY AND THE ENVIRONMENT BY ESTABLISHING AND MAINTAINING IN NUCLEAR POWER PLANTS AN EFFECTIVE DEFENCE AGAINST RADIOLOGICAL HAZARD.

RADIATION PROTECTION OBJECTIVE

ALARA IN NORMAL OPERATION

MITIGATION OF RADIATION EXPOSURES FROM ACCIDENTS

TECHNICAL SAFETY OBJECTIVE

PREVENT ACCIDENTS

ESPECIALLY THOSE WITH HIGH CONSEQUENCES

FUNDAMENTAL PRINCIPLE

AN ESTABLISHED SAFETY CULTURE GOVERNS THE ACTIONS AND INTERACTIONS OF ALL INDIVIDUALS AND ORGANIZATIONS ENGAGED IN NUCLEAR POWER ACTIVITIES.

FUNDAMENTAL PRINCIPLE

THE GOVERNMENT ESTABLISHES THE LEGAL FRAMEWORK FOR A NUCLEAR INDUSTRY AND AN INDEPENDENT REGULATORY ORGANIZATION.

FUNDAMENTAL PRINCIPLE

THE ULTIMATE RESPONSIBILITY FOR THE SAFETY OF A NUCLEAR POWER PLANT RESTS WITH THE OPERATING ORGANIZATION. THIS IS IN NO WAY DILUTED BY THE SEPARATE ACTIVITIES AND RESPONSIBILITIES OF DESIGNERS, SUPPLIERS, CONSTRUCTORS, AND REGULATORS.

FUNDAMENTAL PRINCIPLE

SAFETY IS ACCOMPLISHED THROUGH USE OF DEFENCE IN DEPTH.

FUNDAMENTAL PRINCIPLE

SPECIAL ATTENTION IS DEVOTED TO THE PREVENTION OF ACCIDENTS, PARTICULARLY ANY WHICH COULD CAUSE SEVERE CORE DAMAGE.

FUNDAMENTAL PRINCIPLE

IN-PLANT AND OFF-SITE MITIGATION MEASURES ARE AVAILABLE OR PREPARED WHICH WOULD ENSURE SUBSTANTIAL REDUCTION OF THE EFFECTS OF ANY ACCIDENTAL RELEASE OF RADIOACTIVE MATERIAL.

FUNDAMENTAL PRINCIPLE

NUCLEAR POWER PLANT TECHNOLOGY IS BASED ON ENGINEERING PRACTICES WHICH ARE PROVEN BY TESTING AND EXPERIENCE, AND WHICH ARE REFLECTED IN APPROVED CODES AND STANDARDS AND OTHER APPROPRIATELY DOCUMENTED STATEMENTS.

FUNDAMENTAL PRINCIPLE

QUALITY ASSURANCE IS APPLIED THROUGHOUT NUCLEAR POWER PLANT ACTIVITIES AS PART OF A COMPREHENSIVE SYSTEM TO ENSURE WITH HIGH CONFIDENCE THAT ALL ITEMS DELIVERED AND SERVICES AND TASKS PERFORMED MEET SPECIFIED REQUIREMENTS.

FUNDAMENTAL PRINCIPLE

PERSONNEL ENGAGED IN ACTIVITIES BEARING ON NUCLEAR POWER PLANT SAFETY ARE TRAINED AND QUALIFIED. DESIGN AND OPERATIONS PROMOTE SAFETY THROUGH PREVENTING WRONG ACTIONS AND COMPENSATING FOR THEIR EFFECTS.

FUNDAMENTAL PRINCIPLE

DETAILED SAFETY ASSESSMENTS ARE MADE BEFORE DESIGN AND OPERATION OF A PLANT BEGIN. THESE ARE WELL DOCUMENTED AND INDEPENDENTLY REVIEWED, AND UPDATED AS NECESSARY.

FUNDAMENTAL PRINCIPLE

A SYSTEM OF RADIATION PROTECTION PRACTICES, CONSISTENT WITH RECOMMENDATIONS OF THE ICRP AND THE IAEA, IS FOLLOWED IN THE DESIGN, COMMISSIONING AND OPERATIONAL PHASES.

FUNDAMENTAL PRINCIPLE

ORGANIZATIONS CONCERNED ENSURE THAT OPERATING EXPERIENCE AND THE RESULTS OF RESEARCH RELEVANT TO SAFETY ARE EXCHANGED, REVIEWED, AND ANALYZED, AND THAT LESSONS ARE LEARNED AND ACTED ON.